

## **Interior Lighting Power Density Examples**

The following pages show 4 interior lighting power density (LPD) examples.

The first uses the Building Area Method for an office building.

The second uses the Building Area Method for a multi-occupancy building.

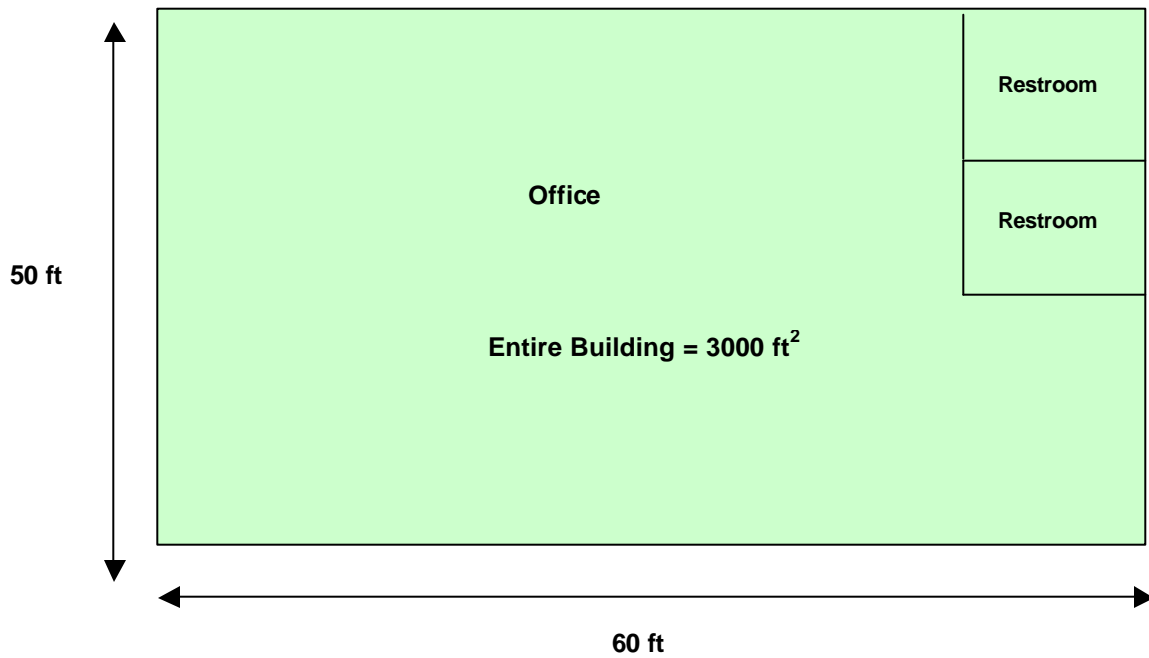
The third uses the Space-by-Space Method for a retail building.

The fourth uses the Space-by-Space Method for a same retail building used in the third example, but adds the optional additional interior lighting power allowance for a display case.

## Interior Lighting Power Density Example

### Using the Building Area Method

#### Office Building



#### Site Information

The building is 3000 ft<sup>2</sup>

The building's primary occupancy is office space

**Using the Vermont 2005 Guidelines for Energy Efficient Commercial Construction lets determine the interior lighting power density allowance (LPD).**

Refer to Table 805.5.2 in the Vermont Guidelines to help determine the maximum interior LPD allowances using the Building Area Method.

From Table 805.5.2 in the Vermont Guidelines the maximum interior LPD for an office building is 1.0 Watts per ft<sup>2</sup>

**Determining the Interior Lighting Power Allowance for the building**

- The building type is an office.
- The maximum LPD for an office is 1.0 W/ft<sup>2</sup>.
- The building area is 3000 ft<sup>2</sup>.
- The Total Interior Lighting Power Allowance is  $1.0 \text{ W/ft}^2 \times 3000 \text{ ft}^2 = 3000$  Watts.

*Refer to the Example Interior Lighting Power Density Worksheet section named Interior Lighting Power Allowance (Building Area Method) to see how this information would be entered on the code compliance worksheet.*

**Determining the Interior Connected Lighting Power**

- The office building had the following lighting installed:
  - Luminaire Description is 3 Lamp F32T8 with electronic ballasts
  - Total number of Luminaires is 30.
  - Watts per Luminaire is 93.
  - The Total Interior Connected Lighting Power is  $30 \text{ Luminaires} \times 93 \text{ Watts per Luminaire} = 2790 \text{ Watts}$ .

*Refer to the Example Interior Lighting Power Density Worksheet section named Interior Connected Lighting Power (Building Area Method) to see how this information would be entered on the code compliance worksheet.*

*Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)*

## INTERIOR LIGHTING POWER DENSITY WORKSHEETS

**10 Energy Way, Megawatt City, VT 05555**

Site Address (street, town, ZIP Code)

**LPD Standard Used**

☐ ASHRAE Standard 90.1-2004

☒ **Building Area Method** – *(Complete Building Area Method Section)*

☐ **Space-by-Space Method** – *(Complete Space-by-Space Method Section)*

### Interior Lighting Power Allowance (Building Area Method)

Building Type	LPD (W/ft²)	Building Area (ft²)	Lighting Power Allowance (W)
Office	1.0	3000	3000
Total Interior Lighting Power Allowance (W)			3000

Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts
3 Lamp F32T8 w/ electronic ballasts	30	93	2790
Total Interior Connected Lighting Power (W)			2790

Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)

## Space-by-Space Method Section

### Interior Lighting Power Allowance (Space-by-Space Method)

Building Type	Space Type	LPD (W/ft²)	Space Area (ft²)	Lighting Power Allowance (W)
N/A				
Total Interior Lighting Power Allowance (W)				

### Interior Connected Lighting Power (Space-by-Space Method)

Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts
<b>Total Interior Connected Lighting Power (W)</b>			

Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)

## Space-by-Space Method Section

### Additional Interior Lighting Power Allowance (Optional)

*The Additional Interior Lighting Power Allowance is an optional section of the Space-by-Space LPD Method to be used only for specific purposes, such as decorative lighting or retail display lighting. The Additional Interior Lighting Power Allowance can only be used for its intended purpose and cannot be traded off to be used for general interior lighting power allowance.*

#### Additional Interior Lighting Power Allowance (Space-by-Space Method)

Space or Display	Type	Area (ft <sup>2</sup> )	Unit Allowance (W/ft <sup>2</sup> )	Allowance (W)	Installed Power (W)
N/A					

#### Additional Interior Connected Lighting Power (Space-by-Space Method)

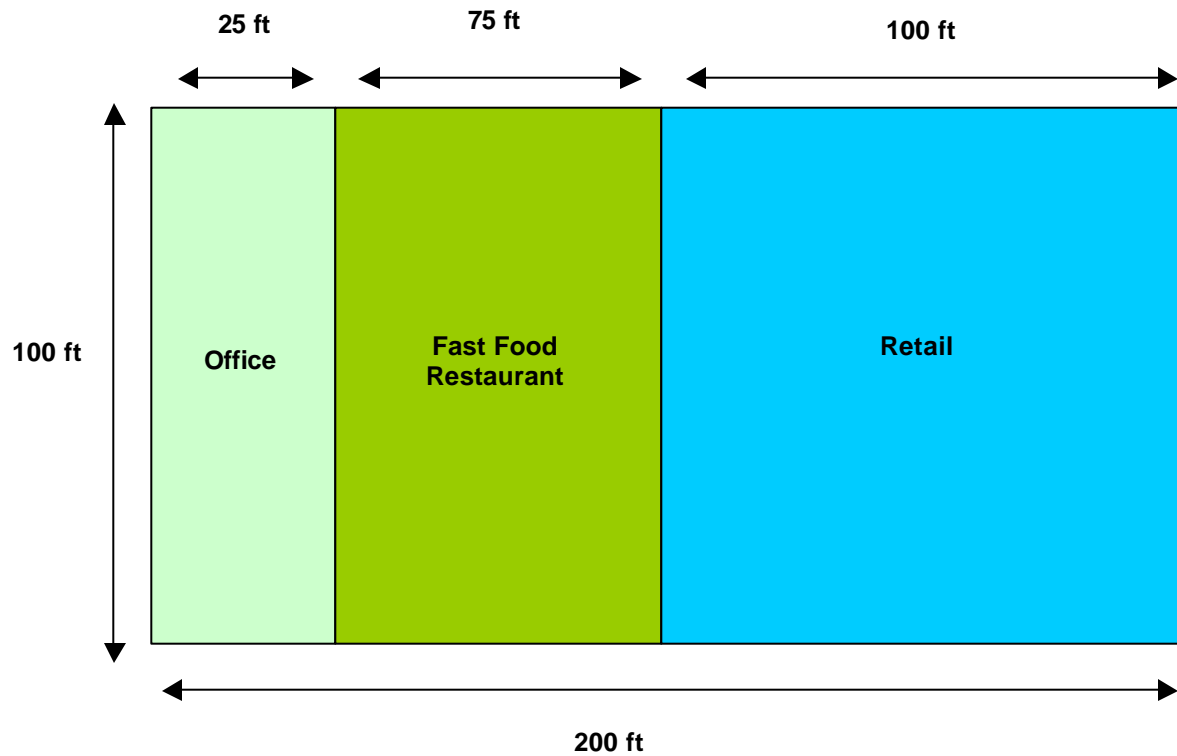
Space or Display	Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts

*Additional Lighting Power Density is in Compliance if the Installed Power (W) is less than or equal to the Allowance (W) for each space or display the additional interior lighting power allowance is used for.*

## Interior Lighting Power Density Example

### Using the Building Area Method

#### Multi-Occupancy Building



#### Site Information

The building is 20000 ft<sup>2</sup>

The building is multi-occupancy that has the following:

Office space at 2500 ft<sup>2</sup>

Fast Food Restaurant space at 7500 ft<sup>2</sup>

Retail space at 10000 ft<sup>2</sup>

## **Using the Vermont 2005 Guidelines for Energy Efficient Commercial Construction lets determine the interior lighting power density allowance (LPD).**

Refer to Table 805.5.2 in the Vermont Guidelines to help determine the maximum interior LPD allowances using the Building Area Method.

From Table 805.5.2 in the Vermont Guidelines the maximum interior LPD for an office building is 1.0 Watts per ft<sup>2</sup>, fast food restaurant is 1.4 Watts per ft<sup>2</sup>, and retail is 1.5 Watts per ft<sup>2</sup>.

### **Determining the Interior Lighting Power Allowance for the building**

- The building type is multi-occupancy that has office space at 2500 ft<sup>2</sup>, fast food restaurant space at 7500 ft<sup>2</sup>, and retail space at 10000 ft<sup>2</sup>.
- The maximum LPD for an office is 1.0 Watts per ft<sup>2</sup>, fast food restaurant is 1.4 Watts per ft<sup>2</sup>, and retail space is 1.5 Watts per ft<sup>2</sup>.
- The Total Interior Lighting Power Allowance is  $(1.0 \text{ W/ft}^2 \times 2500 \text{ ft}^2) + (1.4 \text{ W/ft}^2 \times 7500 \text{ ft}^2) + (1.5 \text{ W/ft}^2 \times 10000 \text{ ft}^2) = 28000 \text{ Watts}$ .

*Refer to the Example Interior Lighting Power Density Worksheet section named Interior Lighting Power Allowance (Building Area Method) to see how this information would be entered on the code compliance worksheet.*

### **Determining the Interior Connected Lighting Power**

- The building had the following lighting installed:
  - Luminaire Description is 3 Lamp F32T8 with electronic ballasts, a total of 240 of these luminaires where installed, and they have 93 Watts per Luminaire.
  - Luminaire Description is 26-W hardwired compact fluorescents with electronic ballasts, a total of 140 of these luminaires where installed, and they have 28 Watts per Luminaire.
  - Luminaire Description is 60-W rated Incandescent lamps, a total of 20 of this luminaires where installed, and they have 60 Watts per Luminaire.
  - The Total Interior Connected Lighting Power is  $(240 \text{ Luminaires} \times 93 \text{ Watts per Luminaire}) + (140 \text{ Luminaires} \times 28 \text{ Watts per Luminaire}) + (20 \text{ Luminaires} \times 60 \text{ Watts per Luminaire}) = 27440 \text{ Watts}$ .

*Refer to the Example Interior Lighting Power Density Worksheet section named Interior Connected Lighting Power (Building Area Method) to see how this information would be entered on the code compliance worksheet.*

*Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)*



## INTERIOR LIGHTING POWER DENSITY WORKSHEETS

**1 Energy Way, Megawatt City, VT 05555**

Site Address (street, town, ZIP Code)

### LPD Standard Used

X

7

ASHRAE Standard 90.1-2004

## Building Area Method Section

Building Type	LPD (W/ft²)	Building Area (ft²)	Lighting Power Allowance (W)
Office	1.0	2500	2500
Fast Food Restaurant	1.4	7500	10500
Retail Store	1.5	10000	15000
Total Interior Lighting Power Allowance (W)			28000

Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts
3 Lamp F32T8 w/ electronic ballasts	240	93	22320
26-W hardwired Compact Fluorescent w/ electronic ballasts	140	28	3920
60-W Incandescent Lamps	20	60	1200
Total Interior Connected Lighting Power (W)			27440

Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)

## Space-by-Space Method Section

### Interior Lighting Power Allowance (Space-by-Space Method)

Building Type	Space Type	LPD (W/ft <sup>2</sup> )	Space Area (ft <sup>2</sup> )	Lighting Power Allowance (W)
N/A				
Total Interior Lighting Power Allowance (W)				

### Interior Connected Lighting Power (Space-by-Space Method)

Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts
Total Interior Connected Lighting Power (W)			

*Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)*

## Space-by-Space Method Section

### Additional Interior Lighting Power Allowance (Optional)

*The Additional Interior Lighting Power Allowance is an optional section of the Space-by-Space LPD Method to be used only for specific purposes, such as decorative lighting or retail display lighting. The Additional Interior Lighting Power Allowance can only be used for its intended purpose and cannot be traded off to be used for general interior lighting power allowance.*

#### Additional Interior Lighting Power Allowance (Space-by-Space Method)

Space or Display	Type	Area (ft <sup>2</sup> )	Unit Allowance (W/ft <sup>2</sup> )	Allowance (W)	Installed Power (W)
N/A					

#### Additional Interior Connected Lighting Power (Space-by-Space Method)

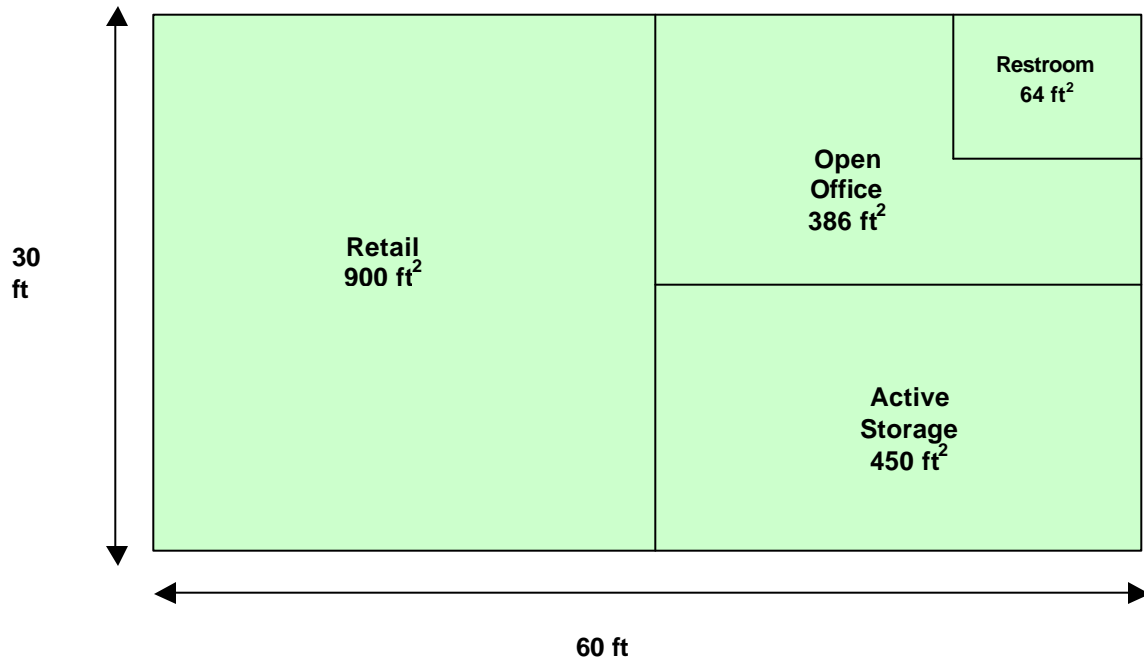
Space or Display	Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts

*Additional Lighting Power Density is in Compliance if the Installed Power (W) is less than or equal to the Allowance (W) for each space or display the additional interior lighting power allowance is used for.*

## Interior Lighting Power Density Example

### Using the Space-by-Space Method

#### Retail Building



#### Site Information

The building is 1800 ft<sup>2</sup>

The building type is Retail and has the following spaces:

Retail space at 900 ft<sup>2</sup>

Storage space at 450 ft<sup>2</sup>

Office space at 386 ft<sup>2</sup>

Restroom space at 64 ft<sup>2</sup>

## **Using the Vermont 2005 Guidelines for Energy Efficient Commercial Construction lets determine the interior lighting power density allowance (LPD).**

Refer to Table 805.5.3 in the Vermont Guidelines to help determine the maximum interior LPD allowances using the Space-by Space Method.

From Table 805.5.3 in the Vermont Guidelines the maximum interior LPD for retail space is 1.7 Watts per ft<sup>2</sup>, active storage space is 0.8 Watts per ft<sup>2</sup>, open office space is 1.1 Watts per ft<sup>2</sup>, and restroom space is 0.9 Watts per ft<sup>2</sup>.

### **Determining the Interior Lighting Power Allowance for the building**

- The building type is retail and has the following spaces, retail space at 900 ft<sup>2</sup>, active storage space at 450 ft<sup>2</sup>, office space at 386 ft<sup>2</sup>, and restroom space at 64 ft<sup>2</sup>.
- The maximum LPD for retail space is 1.7 Watts per ft<sup>2</sup>, active storage space is 0.8 Watts per ft<sup>2</sup>, office space is 1.1 Watts per ft<sup>2</sup>, and restroom space is 0.9 Watts per ft<sup>2</sup>.
- The Total Interior Lighting Power Allowance is  $(1.7 \text{ W/ft}^2 \times 900 \text{ ft}^2) + (0.8 \text{ W/ft}^2 \times 450 \text{ ft}^2) + (1.1 \text{ W/ft}^2 \times 386 \text{ ft}^2) + (0.9 \text{ W/ft}^2 \times 64 \text{ ft}^2) = 2373 \text{ Watts}$ .

*Refer to the Example Interior Lighting Power Density Worksheet section named Interior Lighting Power Allowance (Space-by-Space Method) to see how this information would be entered on the code compliance worksheet.*

### **Determining the Interior Connected Lighting Power**

- The spaces had the following lighting installed:
  - Luminaire Description is 3 Lamp F32T8 with electronic ballasts, a total of 24 of these luminaires where installed, and they have 93 Watts per Luminaire.
  - Luminaire Description is 26-W hardwired compact fluorescents with electronic ballasts, a total of 2 of these luminaires where installed, and they have 28 Watts per Luminaire.
  - The Total Interior Connected Lighting Power is  $(24 \text{ Luminaires} \times 93 \text{ Watts per Luminaire}) + (2 \text{ Luminaires} \times 28 \text{ Watts per Luminaire}) = 2288 \text{ Watts}$ .

*Refer to the Example Interior Lighting Power Density Worksheet section named Interior Connected Lighting Power (Space-by-Space Method) to see how this information would be entered on the code compliance worksheet.*

*Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)*

## INTERIOR LIGHTING POWER DENSITY WORKSHEETS

**1 Energy Way, Megawatt City, VT 05555**

Site Address (street, town, ZIP Code)

LPD Standard Used

## 2005 VT Guidelines For Energy Efficient Commercial Construction

ASHRAE Standard 90.1-2004

☐ **Building Area Method** – *(Complete Building Area Method Section)*

☒ **Space-by-Space Method** – *(Complete Space-by-Space Method Section)*

Building Type	LPD (W/ft²)	Building Area (ft²)	Lighting Power Allowance (W)
N/A			
Total Interior Lighting Power Allowance (W)			

Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts
<b>Total Interior Connected Lighting Power (W)</b>			

Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)

## Space-by-Space Method Section

Interior Lighting Power Allowance (Space-by-Space Method)				
Building Type	Space Type	LPD (W/ft <sup>2</sup> )	Space Area (ft <sup>2</sup> )	Lighting Power Allowance (W)
Retail	Sales Floor	1.7	900	1530
Retail	Storage	.8	450	360
Retail	Office	1.1	386	425
Retail	Restroom	.9	64	58
Total Interior Lighting Power Allowance (W)				2373

Interior Connected Lighting Power (Space-by-Space Method)			
Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts
3 Lamp F32T8 w/ electronic ballasts	24	93	2232
26-W Triple CFL w/ electronic ballasts	2	28	56
Total Interior Connected Lighting Power (W)			2288
Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)			

## Space-by-Space Method Section

### Additional Interior Lighting Power Allowance (Optional)

*The Additional Interior Lighting Power Allowance is an optional section of the Space-by-Space LPD Method to be used only for specific purposes, such as decorative lighting or retail display lighting. The Additional Interior Lighting Power Allowance can only be used for its intended purpose and cannot be traded off to be used for general interior lighting power allowance.*

#### Additional Interior Lighting Power Allowance (Space-by-Space Method)

Space or Display	Type	Area (ft <sup>2</sup> )	Unit Allowance (W/ft <sup>2</sup> )	Allowance (W)	Installed Power (W)
N/A					

#### Additional Interior Connected Lighting Power (Space-by-Space Method)

Space or Display	Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts

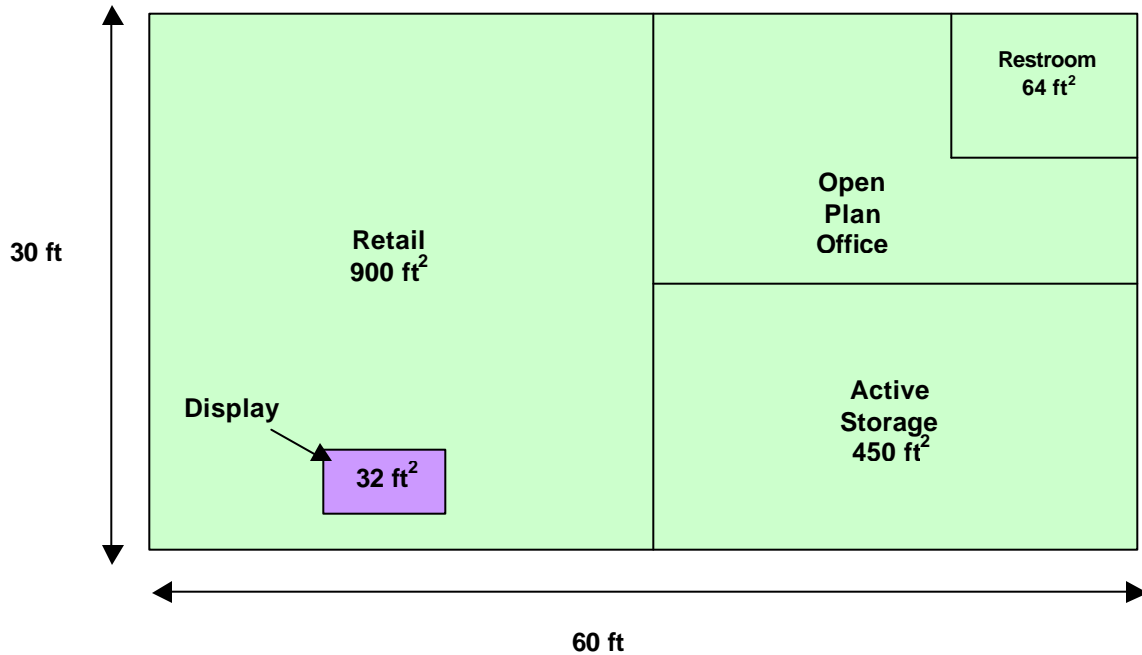
*Additional Lighting Power Density is in Compliance if the Installed Power (W) is less than or equal to the Allowance (W) for each space or display the additional interior lighting power allowance is used for.*



## Interior Lighting Power Density Example

### Using the Space-by-Space Method with the Additional Interior Lighting Power Allowance Option

#### Retail Building



#### Site Information

The building is 1800 ft<sup>2</sup>

The building type is Retail and has the following spaces:

Retail space at 900 ft<sup>2</sup>

Storage space at 450 ft<sup>2</sup>

Office space at 386 ft<sup>2</sup>

Restroom space at 64 ft<sup>2</sup>

In addition the retail space has a 32 ft<sup>2</sup> Display area for fine merchandise

**Using the Vermont 2005 Guidelines for Energy Efficient Commercial Construction lets determine the interior lighting power density allowance (LPD).**

Refer to Table 805.5.3 in the Vermont Guidelines to help determine the maximum interior LPD allowances using the Space-by-Space Method.

From Table 805.5.3 in the Vermont Guidelines the maximum interior LPD for retail space is 1.7 Watts per ft<sup>2</sup>, active storage space is 0.8 Watts per ft<sup>2</sup>, open office space is 1.1 Watts per ft<sup>2</sup>, and restroom space is 0.9 Watts per ft<sup>2</sup>.

**Determining the Interior Lighting Power Allowance for the building**

- The building type is retail and has the following spaces, retail space at 900 ft<sup>2</sup>, active storage space at 450 ft<sup>2</sup>, office space at 386 ft<sup>2</sup>, and restroom space at 64 ft<sup>2</sup>.
- The maximum LPD for retail space is 1.7 Watts per ft<sup>2</sup>, active storage space is 0.8 Watts per ft<sup>2</sup>, office space is 1.1 Watts per ft<sup>2</sup>, and restroom space is 0.9 Watts per ft<sup>2</sup>.
- The Total Interior Lighting Power Allowance is  $(1.7 \text{ W/ft}^2 \times 900 \text{ ft}^2) + (0.8 \text{ W/ft}^2 \times 450 \text{ ft}^2) + (1.1 \text{ W/ft}^2 \times 386 \text{ ft}^2) + (0.9 \text{ W/ft}^2 \times 64 \text{ ft}^2) = 2373 \text{ Watts}$ .

*Refer to the Example Interior Lighting Power Density Worksheet section named Interior Lighting Power Allowance (Space-by-Space Method) to see how this information would be entered on the code compliance worksheet.*

**Determining the Interior Connected Lighting Power**

- The spaces had the following lighting installed:
  - Luminaire Description is 3 Lamp F32T8 with electronic ballasts, a total of 24 of these luminaires where installed, and they have 93 Watts per Luminaire.
  - Luminaire Description is 26-W hardwired compact fluorescents with electronic ballasts, a total of 2 of these luminaires where installed, and they have 28 Watts per Luminaire.
  - The Total Interior Connected Lighting Power is  $(24 \text{ Luminaires} \times 93 \text{ Watts per Luminaire}) + (2 \text{ Luminaires} \times 28 \text{ Watts per Luminaire}) = 2288 \text{ Watts}$ .

*Refer to the Example Interior Lighting Power Density Worksheet section named Interior Connected Lighting Power (Space-by-Space Method) to see how this information would be entered on the code compliance worksheet.*

*Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)*

**Using the Vermont 2005 Guidelines for Energy Efficient Commercial Construction lets determine the additional interior lighting power density allowance (LPD).**

Refer to footnotes for Table 805.5.3 in the Vermont Guidelines to help determine the maximum additional interior LPD allowances when using the Space-by Space Method.

From the footnotes of Table 805.5.3 in the Vermont Guidelines the maximum additional interior LPD allowance for fine merchandise display is 3.9 Watts per ft<sup>2</sup>.

**Determining the Additional Interior Lighting Power Allowance**

- In the retail space there is a 32 ft<sup>2</sup> display used for fine merchandise.
- The maximum additional interior LPD for fine merchandise is 3.9 Watts per ft<sup>2</sup>.
- The additional interior LPD allowance for this display is  $3.9 \text{ W/ft}^2 \times 32 \text{ ft}^2 = 125 \text{ Watts}$ .

*Refer to the Example Interior Lighting Power Density Worksheet section named Additional Interior Lighting Power Allowance (Space-by-Space Method) to see how this information would be entered on the code compliance worksheet.*

**Determining the Additional Interior Connected Lighting Power**

- The display had the following lighting installed:
  - Luminaire Description is one 120-W rated Halogen Lamp.
  - The Total Additional Interior Connected Lighting Power is (1 Luminaire x 120 Watts per Luminaire) = 120 Watts.

*Refer to the Example Interior Lighting Power Density Worksheet section named Additional Interior Connected Lighting Power (Space-by-Space Method) to see how this information would be entered on the code compliance worksheet.*

*Additional Lighting Power Density is in Compliance if the Installed Power (W) is less than or equal to the Allowance (W) for each space or display the additional interior lighting power allowance is used for.*

## INTERIOR LIGHTING POWER DENSITY WORKSHEETS

**1 Energy Way, Megawatt City, VT 05555**

Site Address (street, town, ZIP Code)

LPD Standard Used

☐ ASHRAE Standard 90.1-2004

☐ **Building Area Method** – *(Complete Building Area Method Section)*

☒ **Space-by-Space Method** – *(Complete Space-by-Space Method Section)*

Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)

## Space-by-Space Method Section

Interior Lighting Power Allowance (Space-by-Space Method)				
Building Type	Space Type	LPD (W/ft <sup>2</sup> )	Space Area (ft <sup>2</sup> )	Lighting Power Allowance (W)
Retail	Sales Floor	1.7	900	1530
Retail	Storage	.8	450	360
Retail	Open Office	1.1	386	425
Retail	Restroom	.9	64	58
Total Interior Lighting Power Allowance (W)				2373

Interior Connected Lighting Power (Space-by-Space Method)			
Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts
3 Lamp F32T8 w/ electronic ballasts	24	93	2232
26-W Triple CFL w/ electronic ballasts	2	28	56
Total Interior Connected Lighting Power (W)			2288
Lighting Power Density is in Compliance if the Total Interior Connected Lighting Power (W) is less than or equal to the Total Interior Lighting Power Allowance (W)			

## Space-by-Space Method Section

### Additional Interior Lighting Power Allowance (Optional)

*The Additional Interior Lighting Power Allowance is an optional section of the Space-by-Space LPD Method to be used only for specific purposes, such as decorative lighting or retail display lighting. The Additional Interior Lighting Power Allowance can only be used for its intended purpose and cannot be traded off to be used for general interior lighting power allowance.*

#### Additional Interior Lighting Power Allowance (Space-by-Space Method)

Space or Display	Type	Area (ft <sup>2</sup> )	Unit Allowance (W/ft <sup>2</sup> )	Allowance (W)	Installed Power (W)
Retail Merchandise	Fine	32	3.9	125	120

#### Additional Interior Connected Lighting Power (Space-by-Space Method)

Space or Display	Luminaire Description	# of Luminaires	Watts Per Luminaire	Total Watts
Retail Merchandise	120-W Halogen Lamp	1	120	120

*Additional Lighting Power Density is in Compliance if the Installed Power (W) is less than or equal to the Allowance (W) for each space or display the additional interior lighting power allowance is used for.*